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BLAST SHELTERS

2 suppl

Blueprint for Survival No. **6**



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INTRODUCTION

Canada's defensive programme and emergency plans are based on the assumption that nuclear war is a possibility. An important feature of the preparations are the survival measures which should be carried out by the population.

The Blueprint for Survival Series of pamphlets has been prepared in order to give information and advice on practical survival measures which can be taken by individuals to minimize the effects of nuclear attacks. It must be recognized that if nuclear war takes place, many Canadians would be killed and injured, but the adoption of the recommendations contained in these pamphlets would result in the saving of many lives which would otherwise be lost.

The first two publications in the Series were devoted to the protection of people by means of fallout shelters. These shelters were designed to offer protection against the fallout radiation only. They do not give protection against the effects of initial radiation, heat or the explosion's blast. Nevertheless, fallout shelters in the so-called target areas could be of value if they were more than a few miles from where the explosion took place.

If nuclear war should ever take place, any of our major cities might be attacked with nuclear weapons. People in such cities may now feel that it would be worth while to have a shelter which gave a substantial amount of protection against the combined effects of initial radiation, heat, blast and fallout radiation. Such shelters are known as blast shelters and within the limits described in this pamphlet, give protection against all these effects.

How must a blast shelter be built to give adequate protection? What risks are involved? Why are certain features which are not necessary in a fallout shelter, essential in a blast shelter?

This pamphlet, the sixth in the Blueprint for Survival Series, answers these questions.

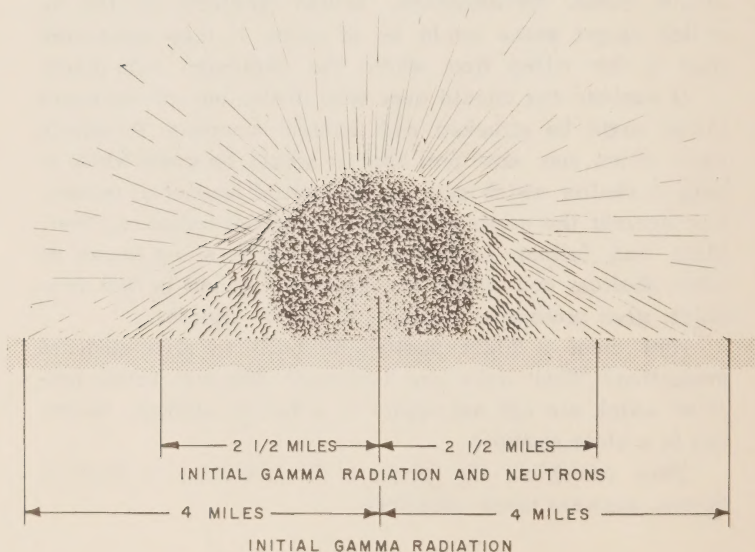
WHAT A BLAST SHELTER IS

When a nuclear weapon explodes, energy harmful to the human body is released in several ways. Obviously, the danger is increased the closer a person is to the explosion. To obtain protection in an area where one or more effects occur, shelters must be designed to resist them. It is worthwhile to know what these effects are.

Radiation

At the time of the explosion, some energy is released as initial radiation. Two significant types are released. First, gamma radiation is a prompt release of high energy rays. They have greater penetrating power than the gamma rays from fallout which become a hazard later. But by the time they have travelled four miles from a 5-megaton explosion, their effect is insignificant. Second, neutrons are released. These are extremely dangerous close to the explosion but will not be harmful beyond two and one half

PROMPT RADIATION



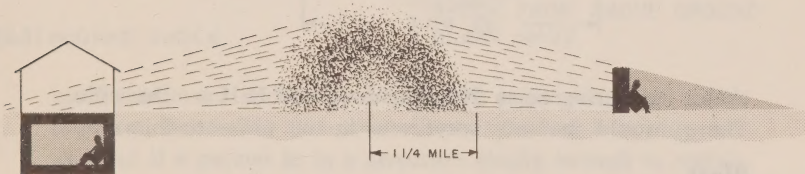
miles. Protection from these radiations can be obtained in much the same way as against fallout radiation. But greater masses of material are necessary to secure protection especially in the case of neutrons.

Heat

The second effect is the enormous amount of energy released as heat. The fireball of a 5-megaton explosion measures $2\frac{1}{2}$ miles across and, on the surface, there are temperatures of tens of thousands of degrees but this diminishes quickly with the distance from the fireball. Nevertheless, the heat from a 5-megaton explosion could cause sunburn-like injuries to unprotected skin 25 miles from the explosion. Within this range, thermal radiation also would set afire thousands of houses, buildings and other combustible materials and structures.

The initial flash lasts about 15 seconds. Clothing will give some protection. Outside the area engulfed by the fireball, a shield between you and the light, for example, a

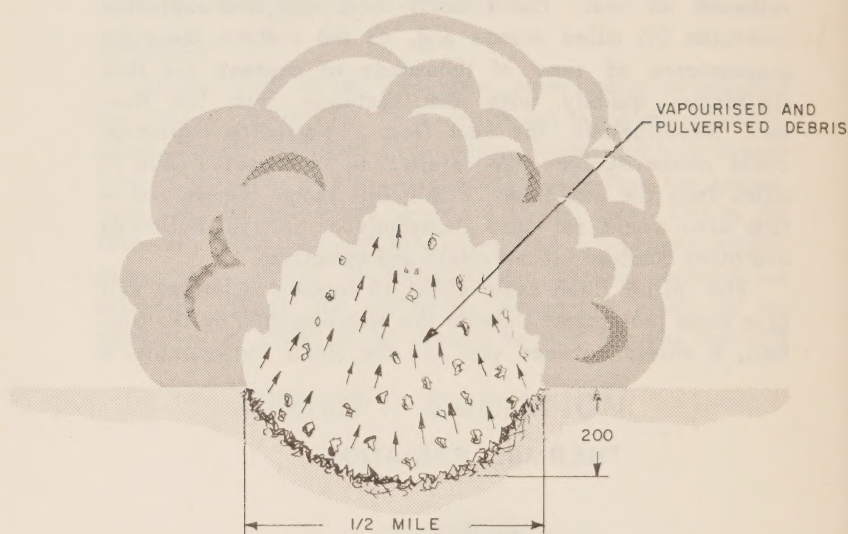
THERMAL RADIATION



stone wall, will give protection against burns from the heat flash. But in areas where subsequent fires started by the heat flash are large and numerous, protection in an insulated structure equipped with its own air supply will be necessary.

Additionally, the intense heat of the fireball vaporizes thousands of tons of earth and debris under the point of explosion leaving, in the case of a 5-megaton explosion, a

FORMATION OF CRATER - 5 MT SURFACE BURST



crater measuring some 200 feet deep and half a mile wide. There would be no survivors in or close to this area.

Blast

The third effect is blast, which is a wave of air at high pressure, moving outward from the explosion. It is strong enough and lasts long enough to destroy buildings out to some miles distance, unless they have been specially built or modified to resist this blast pressure.

In addition, severe ground shocks are transmitted outward from the crater and shock is also transmitted into the ground by the high pressure wave moving over the surface above it. Therefore, to resist these effects, a shelter must

be designed to resist the above ground pressures as well as the below ground shocks.

Persons can be killed or injured by blast in three ways. First, the blast pressure acts directly on weaker parts of the body such as the lungs and eardrums; second, it hurls pieces of debris about at such great speed, they can kill

GROUND SHOCK



EARTHQUAKE SHOCK

SHOCK FROM ABOVE GROUND
BLAST WAVE

or injure; and third, it can throw persons against solid objects. Protection from the effects of blast can only be secured if a person is in a structure strong enough to resist it.

Occupants of a shelter could be killed or injured if the blast entered the shelter. A good blast shelter must have arrangements to keep out the blast. In addition, debris from destroyed buildings may block shelter entrances. Therefore, blast shelters should have some form of alternative exit.

A blast shelter, therefore, is a complicated project because it must provide protection against the almost simultaneous effects of blast, heat and radiation. And the

occupants must survive — not just the shelter. It must be strong enough to resist blast; it must have anti-blast doors and valves to keep out the pressure blast; have insulation against heat; be able to exclude smoke and poisonous gases created by burning buildings; and provide shielding against high initial radiation and the longer lasting hazard of fallout radiation.

Provided there are no ground difficulties such as a high water table or rock, it is more economical to obtain the necessary protection with structures built below rather than above ground. The earth is used to absorb and reduce blast, heat and radiation.

SELECTING A BLAST SHELTER

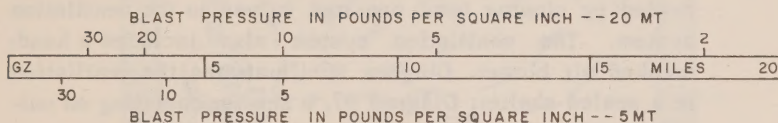
If accurate predictions could be made concerning a nuclear weapon's point of explosion, strength, height of burst and weather conditions at the time of attack, selecting the required type of shelter would be greatly simplified. This is not possible.

It is clear there is a degree of risk in selecting any design. No infallible guidance can be given.

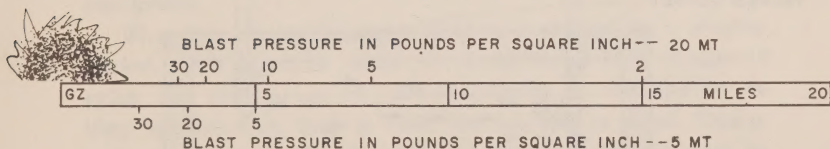
Blast shelters are classified according to their ability to resist pressure. For example, a 10 p.s.i. shelter will resist the pressure in an area where the above ground pressure is 10 pounds per square inch over normal atmospheric pressure.

In Canada, the 5-megaton bomb is taken as a basis for comparing effects at varying distances from the point of the explosion. But here are examples of the distances from both a 5 and 20 megaton explosion at which 10 and 30 p.s.i. shelters will provide protection.

AIRBURST



SURFACE BURST



A 10 p.s.i. shelter would provide adequate protection for the greater portion of the area affected by blast. No shelter has been devised which could ensure survival if it were located in the area of the crater created by the explosion.

INSIDE A BLAST SHELTER

The interior of a blast shelter is much the same as a fallout shelter, with two important exceptions. In a basement fallout shelter, it may not be necessary to store all food, water and fuel within the shelter. Some of this can be kept in the basement. Anything outside a blast shelter may be damaged, therefore, everything necessary for living must be kept inside the shelter.

Secondly, a blast shelter must be sealed at the onset of blast. If the blast doors are closed, the blast actuated valves in the air ducts will complete the sealing by closing automatically, remaining closed until the blast wave has passed. Even after the blast passes, if houses and buildings in the vicinity are on fire, the shelter must be kept sealed by closing hand operated valves in the ventilation system. The ventilation system also includes a hand-cranked air blower. Diagram #6 illustrates the ventilation in a sealed shelter; Diagram #7, a shelter operating on outside ventilation.

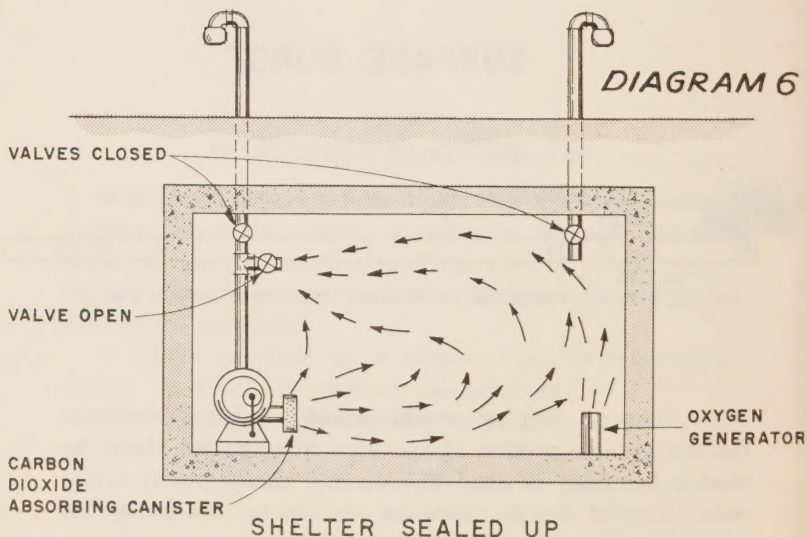
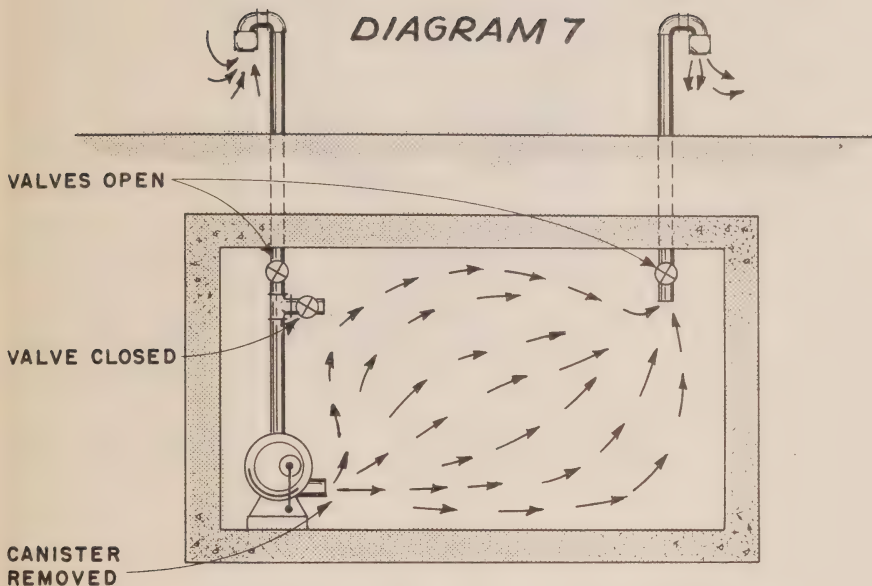


DIAGRAM 7



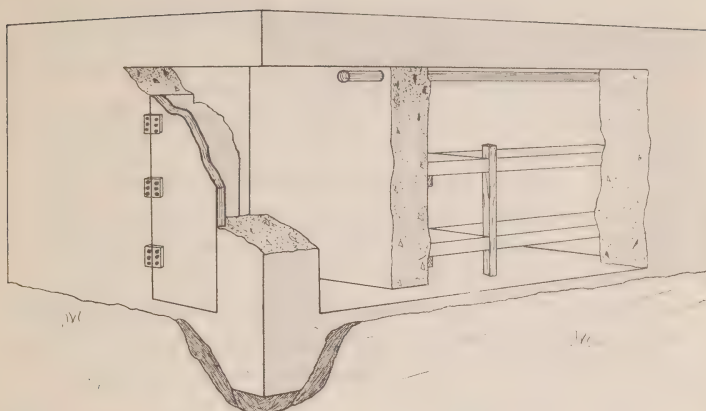
SHELTER - WITH OUTSIDE VENTILATION

Occupants must learn to operate and maintain all shelter equipment.

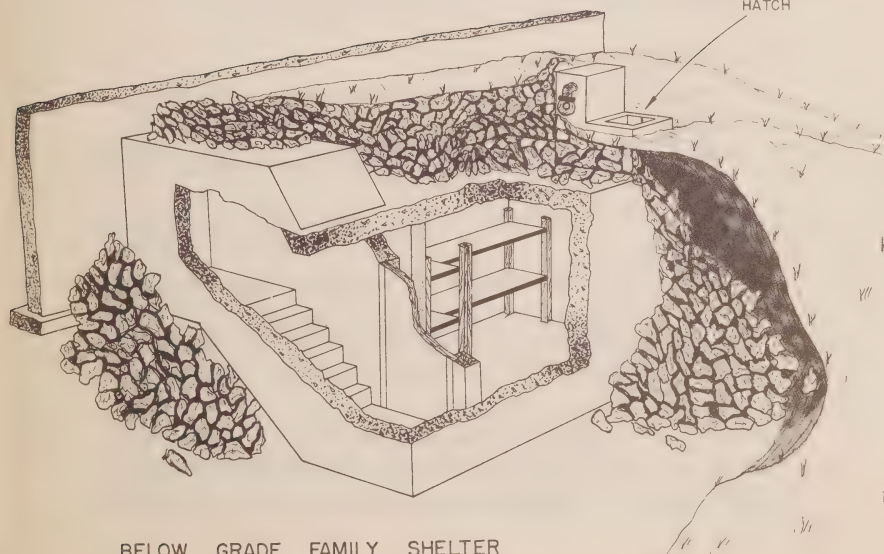
When the occupants are sealed in a shelter for a lengthy period, two hazards must be overcome. The occupants raise the percentage of carbon dioxide in the shelter as they breathe out, and in time the oxygen is used. Equipment to absorb carbon dioxide and generate oxygen must be provided.

Because these shelters are normally underground, air must be drawn into them. Therefore, filters are installed in the blower operated air system in order that radioactive dust will not be drawn into the shelter. Home basement fallout shelters are not equipped with blowers and do not require filters.

ABOVE GROUND
BLAST SHELTER



EMERGENCY ESCAPE
HATCH



BELOW GRADE FAMILY SHELTER
ENTRANCE FROM BASEMENT

LIVING IN A BLAST SHELTER

When a National ALERT sounds:

Move last-minute supplies into the shelter.

Have one of your family listen to the radio.

Turn Off — water mains

— gas, unless it is winter and your house is gas heated.

— cooking and heating appliances other than the furnace.

Leave on the electricity which you may use as long as possible for light and furnace ignition.

When the TAKE COVER sounds:

Go into your shelter.

Fasten door tightly.

Connect radio to shelter antenna.

Sit or lie on the bunks. Avoid contact with the walls.

After a Blast

Leave your shelter and put out any fires you can.

Give any necessary first aid.

Return to your shelter after 20 or 30 minutes as radio-active fallout may start falling on your area.

In the sealed shelter:

If smoke enters the shelter close the hand operated valves.

After approximately 90 minutes fasten a carbon dioxide absorbing canister to the blower.

Operate the blower circulating the shelter air through the canister.

Light one chlorate candle to provide oxygen or put the oxygen system you selected into operation.

Do not cook, heat or smoke as all are dangerous in a sealed shelter.

Use a battery-operated light.

The size of the shelter and blower will determine how often the blower must be used. In a six person family shelter equipped with a 60 cubic feet per minute blower, the blower

must be operated five minutes in every fifteen. The method described should provide air for six hours, thus making possible more than seven hours sealed-up time.

Unsealing Shelter:

Open hand operated valves after seven hours as fires in the vicinity should have burned out.

Remain in the shelter until told by radio or other means that radioactivity has decreased and it is safe to leave.

If natural ventilation is inadequate, use the blower at least once every two hours.

BUT DO NOT open the door to cool the shelter even if it is hot and uncomfortable.

Learn:

To use the escape hatch.

To operate and maintain all equipment.

The details of lighting, heating and cooking in the pamphlet "Your Basement Fallout Shelter - Blueprint for Survival No. 1".

Your life may depend on this knowledge. And it is wise to keep a copy of all operating instructions in the shelter.

HOW TO SELECT A BLAST SHELTER

Decide on the degree of protection you want having regard to the cost.

Study the types of shelters in this pamphlet and those from other sources.

Select the shelter's location on your lot considering whether you want it to open off the basement of your home.

Decide how deep it is to be buried.

Select the design that is most suitable for your requirements.

Look for:

An anti-blast door.

An emergency exit.

Anti-blast valves on air ducts.

Hand operated blower.

Filters in the air system shielded from the shelter occupants and protected by blast valves.

An air regeneration system good for 6 to 8 hours.

Space for storage of food and water inside the shelter.

Sanitary arrangements should be wholly within the shelter.

At least 80 cubic feet air space per person, after storage space has been deducted.

All EMO plans include these features. And if you do not use an EMO design, be sure it is a design approved by EMO. Check them carefully before you buy. The stamp of approval looks like this —

DESIGN SERIAL NO.	
This design has been reviewed solely for its protective properties and is approved as a	
.....	
DATE	R. B. CURRY Director Emergency Measures Organization

Radio reception in Blast Shelters may be limited or even impossible unless the radio is attached to an outside aerial. Not all battery operated radios have an attachment for an outside aerial. Check your radio for reception inside the shelter at the first opportunity.

Advice on reputable contractors can be obtained from your local Better Business Bureau, the Canadian Construction Association or the National Housebuilders' Association. And you should obtain legal advice when signing a contract.

EMO DESIGNS

A series of preliminary blast shelter designs has been prepared. They will give families protection from blasts producing up to either 10 or 30 pounds per square inch over atmospheric pressure. There are designs for above, partially above and completely below ground. The shelters are illustrated in the accompanying diagrams. Because of the complexity and size of the engineering drawings for each of these designs, they are not reproduced in this pamphlet. A list of the various sets of drawings available is given on page 16. These, together with suitable specifications can be obtained by writing to:

EMO

P.O. Box 10,000,

YOUR Provincial Capital (NOT Ottawa).

Some commercially developed shelters are blast resistant. These include reinforced concrete designs and buried structures of steel such as tanks and corrugated metal sheets. A list of manufacturers having approved designs may be obtained by writing to the address above.

LIST OF EMO BLAST SHELTER DESIGNS AVAILABLE

(Each set includes specifications)

- R Set No. 2 – 10 p.s.i. Family Blast Shelter.
- ✓ Set No. 3 – 30 p.s.i. Family Blast Shelter.
- R Set No. 4 – 30 Person Blast Shelters.

BLUEPRINT FOR SURVIVAL SERIES

- ✓ No. 1 – Your Basement Fallout Shelter (EMO)
- R No. 2 – Basement Fallout Shelter (CMHC)
- ✓ No. 3 – Fallout on the Farm (Agriculture)
- ✓ No. 4 – Eleven Steps to Survival (EMO)
- R No. 5 – Survival in Likely Target Areas (EMO)
- ✓ No. 6 – Blast Shelters (EMO)

ROGER DUHAMEL, F.R.S.C.
QUEEN'S PRINTER AND CONTROLLER OF STATIONERY
OTTAWA, 1962

Cat. No. S82-662

